TYPICAL FLIES

A PHOTOGRAPHIC ATLAS

BY
E. K. PEARCE

SECOND SERIES

CAMBRIDGE
AT THE UNIVERSITY PRESS
1921

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TYPICAL FLIES

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PREFACE TO THE SECOND SERIES

THIS supplementary volume of *Typical Flies* endeavours to complete the series of British Types, which, before the Great War, Professor Theobald was good enough to select and suggest as a sort of itinerary. And his notes in both volumes, especially those on larvae in the present volume, have greatly added to their value. Thanks are due in addition to the British Museum; to the Museum of Mr Rothschild at Tring, for the loan of micro-slides of the Nycteribiidae; and to Mr H. Waddington, of Bournemouth, for micro-slides of the Culicidae. To the late Mr F. C. Adams, of the New Forest, and to Mr N. D. F. Pearce, of Grantchester, for various notes and specimens captured by them[1]. The only specimens which were included in the original list, and have not been obtained sufficiently well set for photography, are those of Medeterus micaceus, Agromyza lutea, Diplosis pyrivora, and of Oscinis frit, to be added later.

To Mr Harwood, of Sudbury (Suffolk), I am again greatly indebted for many specimens, especially those of Trypetidae[2], and seq. There appeared to be no recent illustrations of these beautiful flies and similar species, or even of some rare and common flies, of which identification is difficult. So these, too, have been included in this little volume.

It is not claimed that the venation is always clear; that would be difficult to secure in many cases: but every effort has been made to give a clue to the collector. Whenever possible a comparison with actual named specimens in collections and museums, or with lens, is desirable. The requirements of the Dipterist have been dealt with in the previous volume. They include a good net, bottles, pins, fine brushes, and forceps, for setting. Setting boards, killing bottles, cork-lined boxes for keeping specimens (in these expensive days of cabinets), a low-power microscope, and a good hand lens are desiderata. The hours for collecting are those of calm, March to October; a warm sun is essential. For unknown reasons specimens not only inhabit

[1] I greatly regret to hear of the death of Mr Adams since this series of *Typical Flies* went to press.

[2] In the *Entomologist's Record and Journal of Variation* Mr T. C. Collins deals with the variation in wing markings of Trypetidae, stating that the banded mottled wings constitute specified and even generic characters.

certain districts, but as often desert them for even a term of years. Nevertheless, it is in well-known resorts that the capture of certain species is alone possible. A classification of Brauer will be found in this volume, as in its predecessor; a cross marks the specimens contained in this volume, and a star intimates they will be found in the preceding volume. It is hoped that this little book may not be in vain in inducing students to commence a study of wide possibilities.

The following books may be of use to the student:

Theobald's *Monographs of the Culicidae.* (British Museum: some of which are out of print.)

Verrall's *List of British Diptera.*

„ *British Flies* (two volumes).

Austen's *Bloodsucking Flies.* (British Museum of Natural History.)

Parasitology, Vol. IX, No. 4. July 27, 1917. C.U.P. Notes on Nycteribiidae.

Staveley's *British Insects.*

Instructions for Collectors. (British Museum.)

Insects at Home. (Wood.)

A map showing known distribution of Anopheles mosquitos. (British Museum.)

In the Exhibited Series of Insects in the Department of Zoology, British Museum (Natural History), Cromwell Road, S.W., will be found a short series of British Diptera: those in table cases having fine enlarged coloured illustrations on the lids of the cases, of great use to students—the main collections of the Museum being reserved elsewhere.

E. K. PEARCE.

KEMPSTON, BOURNEMOUTH,
Aug. 16th, 1921.

PREFACE TO THE FIRST SERIES

THE study of Diptera (two-winged flies) is rendered peculiarly difficult by the lack of elementary treatises on the subject. Certain groups are fully treated in the two large (and costly) volumes published by the late Mr Verrall, there are a few scattered papers in various magazines, and one or two monographs (such as Lowne's on the Blowfly); but there is nothing to compare with the numerous manuals dealing with Lepidoptera and Coleoptera, to name two orders only. This little book does not claim to fill the gap, but it is hoped that it may be of some use to the beginner, and attract attention to an order which possesses great interest, and is moreover of much economic importance. It is chiefly a picture book, as pictures appeal more to the eye than many pages of letterpress; and an important dipterous character—the venation of the wings—can be rendered with fidelity in a photograph.

I have found it difficult to obtain specimens set sufficiently flat for photographic reproduction; since, in photographing on the enlarged scale required, no amount of "stopping down" will produce an image sharp all over, unless the subject be fairly in one plane: in addition to this, some species when set and dried shrivel up, and give but a poor idea of their appearance when fresh. This of course chiefly applies to the *bodies* of flies, the wings and legs are not so affected.

Flies may be taken with the usual entomological net, preferably a green one, as less likely to cause alarm than a white one. Mosquito netting, which may be dyed the required colour, is much better than green leno. The net should be fairly large, but light and easily managed, as many flies are very swift and strong on the wing. When caught, the fly may be transferred to a glass bottomed entomological box: a good supply should be carried, and it is better that only one specimen be placed in a box. On returning home the flies may be killed in a laurel bottle, care being taken that the leaves do not become mildewed, which would probably ruin the specimens; a circular piece of white blotting paper should be placed over the leaves, and frequently renewed. Flies should remain in the bottle till they are thoroughly relaxed, which will require a day or two; if left too long they become rotten

and easily break whilst setting. Narrow boards, such as are used for the smallest lepidoptera, will be suitable for large and medium sized flies; small ones may be set on strips of flat cork, covered with thin white paper. Entomological forceps will be needed to insert the pin in the thorax of the fly; I prefer these curved, as they are also useful for moving pinned specimens. If the flies are to be photographed the pin must be cut off as short as possible above the thorax, and the cut end blackened with a touch of "matt black." No. 20 pins will be useful for most flies, though the large species require something stronger, whilst the very small ones, if pinned at all, require the finest silver pins obtainable. Taylor, New Hall Works, Birmingham, will supply a sample card of pins. For setting, strips and triangles of stiff writing paper, to hold legs and wings in place, and a stiff sable paint-brush, a few handled bristles and a fine needle or two, also handled, will do all that is required: a lens is indispensable in setting small flies, and may with advantage be mounted on a simple stand to leave both hands free. Some flies, especially the Tachinidae, are very brittle: care must be taken in manipulating them. Culicidae should be set *and photographed* as quickly as possible, they very soon shrivel. Other flies may remain about ten days on the setting boards. As to numbers, half a dozen specimens should be ample, both sexes being represented, where possible. Fewer will often have to suffice with rare species, and for purposes of photography *one* well set specimen would be sufficient, were it not for the ever present risk of damage in moving from the store box: the slightest touch or jar will often cause the loss of a leg or antenna, and the attempt to replace these is seldom successful.

Store boxes may be had in many sizes (10×8 inches is as good as any); whatever size is used should be adhered to, as far as possible, for the sake of uniformity. They should be carefully examined for mites, a great enemy to the collector; even new boxes are sometimes contaminated. In sending flies by post it is well to use two boxes, pinning them well into the inner, and supporting them by extra pins if possible; then packing the box with shavings inside a larger one. The label will of course be *tied* on. When finally pinning flies into the store box it is essential to use a small label giving date and locality, which can be pinned, written side down, by the same pin as the specimen. The name, etc. of the fly is written on a second label and pinned behind it in the box: the sex should be marked, where known, and a number added to correspond with that in a notebook, where fuller details may be recorded. Flies should be stored in a cool

dry place, free from accidental jars and careless handling. Naphthalin wrapped in a piece of net should be pinned in a corner of the box as a guard against mites, the great enemy of the dipterist as of the entomologist in general.

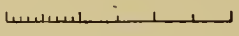
The chief season for collecting in this country is from March till October, the sunny forenoon being the best time. Windy days are very unproductive. Even well-known and good localities are sometimes a blank, from causes we do not know, for flies seem very capricious in their habits. But, like other creatures, they have special haunts where they may usually be found at the proper season, and where they may be expected to occur if carefully searched for. Considerable experience in their habits and localities is needed by the collector. Generally speaking, umbelliferous plants, also bramble, hawthorn and ivy bloom seem to be most attractive. Flies often settle upon gate-posts, railings, and tree-trunks, especially if wounded or decayed. Others frequent salt-marshes and swamps, ponds and river-sides; whilst heath-lands, sheepruns, bare hot sandy areas and commons attract others. Horse and cattle droppings and decomposing animal and vegetable matter are well-known baits for many species. Others attack living animals, not excepting man; and certain flies prey on insects and spiders. Should horses or cattle be approached for the purpose of taking flies, much care must be exercised, as a net will generally stampede them; it is difficult to employ it to advantage under such conditions.

This little book has received the kind encouragement of many entomologists, among whom I may mention Professor Nuttall and Mr Warburton, both of Cambridge. Much practical help in the selection of species, and information as to types selected and their larvae, has been afforded by the kindness of Professor Theobald, whose assistance, it is hoped, has added greatly to the utility of this book. Thanks are also due to Mr Harwood, of Colchester, for the fine specimens of diptera which he has furnished for the photographs herewith presented. It has not always been possible to do them justice, owing to the difficulties previously noted as besetting the photographer. Mr H. Waddington kindly supplied some fine microscopic slides. The author's brother, Mr N. D. F. Pearce, has also helped with the illustrations, as to the success of which the reader must be left to judge. Acknowledgement has been made in every case, it is thought, where help has been received: and if this effort is successful it is hoped that it may be some day supplemented by a further series of pictures, to fill a few gaps that were unavoidable in the present volume.

The life history (ovum, larva, pupa) of many of the species shown is yet to be traced by entomologists. Measurements are given in every case in millimetres (25 mm. = 1 inch), the first dimension being the length of the fly, and the second the expanse of wings. For various reasons it has not been found possible to reproduce the specimens on one uniform scale: the same difficulty was met with by Dr Michael in illustrating the Oribatidae.

E. K. PEARCE.

BOURNEMOUTH.
June 1915.



Scale of 3 centimetres of which one is divided into 10 millimetres.

BRAUER'S CLASSIFICATION OF DIPTERA

(† A cross denotes that the family is illustrated in this book. * An asterisk intimates they will be found in the preceding volume.)

Sub-order 1. ORTHORRHAPHA

Larva with a distinct head. Pupa obtected.

The adult escapes from the pupal skin by a straight dorsal slit which may be transverse but is more usually longitudinal. Imago lacks the frontal lunule and ptilinum.

Sub-order 2. CYCLORRHAPHA

Larva without any distinct head. The Pupa coarctate.

The adult escapes from the puparium through a more or less round opening at the anterior end. Frontal lunule present; ptilinum usually present.

Sub-order 1. ORTHORRHAPHA

Section I. NEMATOCERA

Antennae long and thread-like, composed of many similar or very similar segments. The maxillary palpi usually elongate and flexible of from 2 to 5 segments. Second long vein often forked.

Section II. BRACHYCERA

Antennae usually of three segments, the third usually elongated and sometimes composed of a number of indistinct sub-segments and often bearing a style or arista. Maxillary palpi of 1 to 2 segments, not flexible. Second long vein not forked. Squamae completely concealing the halteres.

1. **THE ORTHORRHAPHA.** Section I. NEMATOCERA contain the following families:

*1. [1] Pulicidae (Fleas).
*2. Cecidomyidae (Gall Midges).
†*3. Mycetophilidae (Fungus Gnats).
†*4. Bibionidae (Fever Flies, St Mark's Flies).
†*5. Simuliidae (Sand Flies).
*6. Chironomidae (Midges).
7. Orphnephilidae.
†8. Psychodidae (Owl Midges).
†*9. Culicidae (Mosquitoes).
†10. Dixidae.
*11. Ptychopteridae (False Daddy Long Legs).
*12. Limnobiidae (False Daddy Long Legs).
†*13. Tipulidae (True Daddy Long Legs).
*14. Rhyphidae (Window Flies).

Section II. BRACHYCERA

†*15. Stratiomyidae (Chameleon Flies).
†*16. Tabanidae (Gad Flies).
*17. Leptidae (Leptis Flies).
†*18. Asilidae (Robber Flies).
†*19. Bombylidae.
*20. Therevidae.
†21. Scenopinidae.
†22. Cyrtidae.
†*23. Empidae (Empis Flies).
†*24. Dolichopodidae.
†25. Lonchopteridae.

2. **THE CYCLORRHAPHA.** Section I. ASCHIZA

Frontal lunule more or less indefinite; no frontal suture.

*26. Platypezidae.
†27. Pipunculidae.
†*28. Syrphidae (Hover Flies).

[1] These are by some raised to the rank of an order called *Aphaniptera* or *Siphonaptera*, but there is no reason whatever for separating the Fleas or Pulicidae from the Diptera.

Section II. SCHIZOPHORA

Frontal lunule and frontal suture marked.

Sub-section A. MUSCOIDEA

Produce ova as a rule.

Sub-section B. PUPIPARA

Produce fully matured larvae.

Sub-section A. MUSCOIDEA

Series *a*. *Acalyptrata*

Squamae small, not concealing the halteres.

Series *b*. *Calyptrata*

Squamae concealing the halteres.

Section II. SCHIZOPHORA

Sub-section A. MUSCOIDEA. Series *a*. *Acalyptrata*

*29. Conopidae.
†*30. Cordyluridae.
31. Phycodromidae.
32. Helomyzidae.
33. Heteroneuridae.
†*34. Sciomyzidae.
†35. Psilidae.
36. Micropezidae.
†37. Ortalidae.
†*38. Trypetidae.
†39. Lonchaeidae.
40. Sapromyzidae.
†41. Opomyzidae.
42. Sepsidae.
†43. Piophilidae (Cheese Flies, etc.).
44. Geomyzidae.
45. Ephydridae.
†46. Drosophilidae.
*47. Chloropidae (Gout Flies).
48. Milichidae.
49. Agromyzidae.
†50. Phytomyzidae.

51. Astiadae.
†52. Borboridae.
†53. Phoridae.

Sub-section A. MUSCOIDEA. Series *b. Calyptrata.*

†*54. Oestridae (Warble Flies).
†*55. [1]Tachinidae (Tachina Flies).
†*56. Muscidae (House Flies, etc.).
†*57. Anthomyidae (Root-feeding Maggots, etc.).

Sub-section B. PUPIPARA

†*58. Hippoboscidae (Forest Flies).
†59. Braulidae (Bee Flies).
†60. Nycteribiidae (Bat Flies).

[1] The Sarcophaginae and Dexinae are sometimes separated from the Tachinidae as two separate families.

ERRATA

Figs. 46, 47. For *Anthrax circumdatus* read *Villa circumdata* Mg.

Fig. 48. For Habitat of *Anthrax circumdatus* read Habitat of *Villa circumdata.*

Fig. 72. For *Spilogaster Zöe* ♂ read *Spilographa Zöe* Mg. ♂

Fig. 91. For *Spilographa Zöe* Mg. ♂ read *Spilographa Zöe* Mg. ♀

Fig. 1. *Platyura marginata* Mg. 8 × 12 mm. Found by sweeping. Most species inhabit woods and thickets. The larvae of *Platyura* feed on fungi. "Appearance in the New Forest, spasmodic." (Adams.) Colchester.

Fig. 2. *Scatopse notata* L. 4×7·5 mm. Plentiful on windows end of May. The larvae live on vegetable and decaying matter. They are long and fusiform and show two points at the sides of the prothorax, and of the eight basal segments of the abdomen, which ends in two rather long divergent setae. (Theobald.) Found at Grantchester.

Fig. 3. *Dilophus febrilis* L. ♂ 4×9 mm., ♀ 5×11 mm. Abundant on Wild Parsnip, though named *febrilis* by Linnaeus, owing to the general opinion in Sweden that the fly resorted to houses where intermittent fever existed. Curtis states that this species causes much mischief in gardens. The so-called fever fly gets into Hop cones in Kent now and then, and causes loss by destroying their brightness. The larvae live in all manner of roots besides hops, and do no little damage. (Theobald.)

Fig. 4. Ova, *Simulium cinereum* Ltr.

Fig. 5. Pupa, *Simulium.*

Fig. 6. Larva, *Simulium.*

Fig. 7. Habitat, *Simulium.* (N. D. F. P.)

Figs. 4, 5, 6, 7. *Simulium cinereum* Ltr. Larva 4·5 mm., Pupa 4·5 mm., Ova, area, 4 mm. Habitat in the Bourn Brook, Grantchester. Sand flies are abundant in damp and sandy and marshy places, and attack man and animals as mosquitoes do. (See *Typical Flies*, fig. 11.)

Fig. 8. *Pericoma compta* Eat. 2×8·5 mm. Rarely sucks blood; larvae aquatic. Larvae of *Pericoma* have 2 rows of curved veins down the body.

Fig. 9. *Psychoda phalaenoides* L. 12 xi. 1891. 4 mm. from tip of wing to base of abdomen. Larvae live in rotting vegetable matter and dung; the pupae inactive, with 2 long tubes like antenna stigmata. The abdomen tapering. (Theobald.)

Fig. 10. *Psychoda sexpunctata* Curt. 3×7 mm. On windows in April. The larvae live in dry cow-dung. They are long, subfusiform and depressed, with a slender straight cylindrical tail, longer than the preceding segment. (Figured by Bouché and M. Perrin.) (Theobald.) Grantchester.

Fig. 11.

Fig. 12.

Fig. 13.

Figs. 11, 12, and 13. *Corethra plumicornis* F.

Fig. 11. ♂ 6 mm. to end of abdomen.
Fig. 12. ♂ 6×9 mm.
Fig. 13. ♀ with wings closed, wings 5 mm.

The larva of *Corethra* catches prey with its antennae, sweeping as do others of the Culicidae. (Figs. 11, 12, 13 micro-mounts, Waddington.)

Fig. 14. Larva, *Corethra*. Introvert, plain.

Fig. 15. Larva, *Corethra*. Introvert, with included air vesicle.

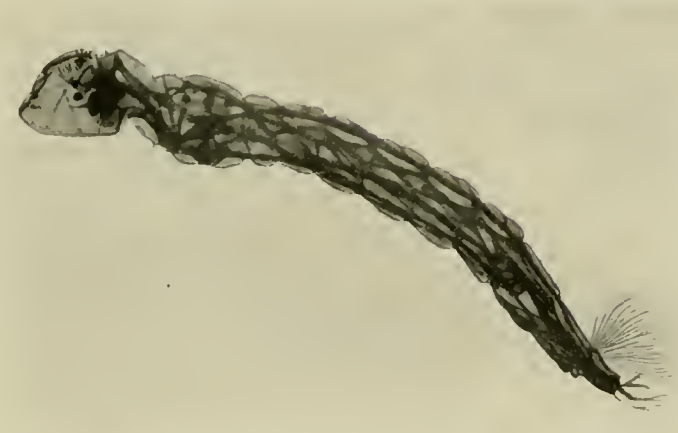


Fig. 16. Larva, *Corethra*.

Fig. 17. Pupa, *Corethra*.

Figs. 14–17. *Corethra plumicornis* F.

Fig. 14. Larva showing introvert 2·5 mm. from back of head to end of introvert.

Fig. 15. Larva showing proboscis 3 mm. from back of head to end of proboscis.

Fig. 16. Transparent larva, 7 mm.

Fig. 17. Pupa, 7 mm.

(Micro-slides, Waddington.)

Fig. 18. *Mochlonyx velutinus* Ruthé. ♂, 7 mm.

Fig. 19. Larva, *Mochlonyx*. 6 mm.

Fig. 20.

Fig. 20. Pupa, *Mochlonyx*. 4·5 mm. (Micro-slides, Waddington.)

The larvae of *Mochlonyx* are found resting on water in Bournemouth neighbourhood. Second breathing tube out of focus and not shown.

Fig. 21. *Aedes cinereus* Mg. 4×7 mm.

Fig. 22. Antennae of *Aedes cinereus*. 1·5 mm. (Micro-slides, Waddington.)

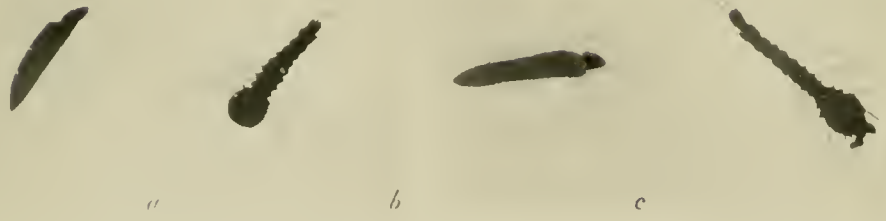


Fig. 23. *Anopheles*. (*a*) Ovum showing emergence exit, ·5 mm.; (*b*) larva just emerged, ·5 mm. (bred Waddington); (*c*) ovum showing floats, ·5 mm.; (*d*) larva bred out, 1 mm., one day old. (Micro-slides, Waddington.) The ova are not deposited in rafts as in *Culex*, but singly amongst weed, and tend to arrange in groups or stars, coming together after deposition perhaps in a "Polar Star arrangement." (Waddington.) White when deposited, turn dark rapidly. Note air cells at sides of ovum, fig. *c*. Cp. with egg raft of *C. pipiens*, fig. 11 *Typical Flies*, and *Anopheles*, figs. 14, 15 *Typical Flies*.

Fig. 24.

Fig. 25.

Fig. 24. Larva, *Culex vexans*. 7 mm.
Fig. 25. Pupa, *Culex vexans*. 4·5 mm.
(Micro-slides, Waddington.)

Fig. 26. *Dixa* Mg. 2·5 × 5 mm. Bred Waddington from Kempston fountain. Larvae aquatic, resemble somewhat those of mosquitoes. Flies found in bushy, moist places, and dance in swarms in the air. (Theobald.)

Fig. 27. *Tipula marmorata* Mg. 14 × 30 mm. Dunbarton.

Fig. 28. *Niphura nigricornis* Mg. ♂ 16×25 mm., ♀ 19×32 mm. Larvae feed on oak borings. 23 v. 1908. Hut Wood, New Forest. (Beck.) A scarce species.

Fig. 29. *Ctenophora ornata* Mg. ♂.
♂ 16 mm. Wings each 14 mm. ♀ 19 mm. Wings each 15·5 mm. Bred by Dr Sharp, New Forest, from pupae in rotten tree.

Fig. 30. *Ctenophora ornata* Mg. ♀.

Fig. 31. *Nemotelus notatus* Ztt. ♂ 5 × 11 mm., ♀ 5 × 12 mm. ♂ cream-coloured abdomen, spotted with black. ♀ abdomen almost wholly black. Often found in company of *N. uliginosus*. Sometimes in great numbers on the salt marshes in the Thames Estuary. This extends to the mouth of the Colne River. These flies are slow in movement, and are found on flowers, rushes, and grass. St Osyth, E. Coast. (Harwood.)

Fig. 32. *Odontomyia tigrina* F. ♂ 8·5 × 17 mm., ♀ 8 × 16 mm. Taken hovering over waterplants and about flowers of Water Buttercup (*Ranunculus sceleratus*). (Harwood.)

Fig. 33. *Microchrysa polita* L. ♂ 4·5 × 10 mm., ♀ 4·5 × 11 mm. Common, sunning itself on leaves of various plants, May to July.

Fig. 34. *Beris vallata* Forst. ♀ 5 × 11 mm. Folded wings 7 mm. head to tip of wing. New Forest, 15 vii. 1899. The commonest species of the genus, closely allied to *B. clavipes*, which is distinguished by its larger size and black instead of yellow pubescence of abdomen, and in the female by its infumated wings. (Harwood.

Fig. 35. *Therioplectes micans* Mg. 14 × 20 mm. "Not common in N. Forest" (Adams). This group is split off from *Tabanus* by hairy eyes, and in all the species of both genera the ♀ is much commoner than the ♂. (Clifton College.) British Museum specimen.

Fig. 36. ♂.

Fig. 37. ♀.

Figs. 36, 37. *Tabanus autumnalis* L. ♂ 16 × 33 mm., ♀ 19 × 36 mm. Usually found at rest on trees and posts in and near woods, especially in late afternoons. Bites horses and cattle. Does not appear to bite human beings as vigorously as some others of this group. Habitat of the fly and mouth parts here shown. Known popularly as Gad Flies or Breeze Flies.

Fig. 38. Mouth parts of *Tabanus autumnalis*.

Fig. 39. Habitat of *Tabanus autumnalis*. (Thomas.) Charborough Park, Dorset.

Fig. 40. *Chrysops caecutiens* L. ♀ 9 mm. from frons to tip of abdomen, 13 mm. from frons to tip of wings. The male has abdomen entirely black, and is rarely taken. ♀ in swarms in damp weather in woods. Compare with Figs. 41–43. See *Typical Flies*, Figs. 43–48.

Fig. 41. ♂.

Fig. 43. ♀.

Fig. 42. ♀.

Figs. 41, 42, 43. *Chrysops sepulcralis* F. In these flies the ♀ vary in length from 6 mm. to 8 mm. In case of ♂ solitary or sparse, found on grass or rush in bogs, and very swift in movement. In case of ♀ in swarms, and alighting on people. Abundant in certain marshy localities near Wareham, Dorset. On Morden Heath, in three days of two or three hours, 140 were taken, all ♀. The ♂ were taken in twos or threes, July 1917, 1918, mainly in swamps. ♂ 7 × 15 mm. In ♀ spread of wings 13 to 16 mm.

Fig. 44. *Laphria flava* L. ♀ 17×37 mm. A rare species found at rest on logs in pine woods in Scotland and Nethy Bridge, end of June. Cp. ♂ fig. 59 *Typical Flies*. (P. Harwood.)

Fig. 45. *Philonicus albiceps* Mg. Figured at rest. ♂ 16 mm., ♀ 15 mm. from frons to extremity of abdomen. Southbourne, vii. 18.

Fig. 46. ♀.

Fig. 47. ♂.

Figs. 46, 47. *Anthrax circumdatus*. ♀ 11 × 25 mm. Taken in numbers on bare paths, Wareham Heath, by N. D. F. Pearce and E. K. Pearce, August 1917, 1918. ♂ taken by the late Rev. O. Pickard-Cambridge (Bloxworth). Species parasitic in the nests of bees (Megachile and Anthophora), *vide* Westwood on Insects, vol. II. p. 544. (Theobald.)

Fig. 48. Habitat of *Anthrax circumdatus*, Wareham Heath.

Figs. 49, 50. *Bombylius minor* L. ♂ 8 × 22 mm., ♀ 9 × 21 mm. Wareham and Morden Heath, hovering over heather and ditches, probably coincident with a bee host; seen to be hunting banks, evidently for the object of ovipositing. Distinguished from *canescens* by white pubescence on frons, in varying amount. (*Canescens* could not be found on Wareham Heath.)

Fig. 51. *Scenopinus fenestralis* L. 5·5 × 11 mm. On windows end of summer and outhouses. (Adams, New Forest.) Larvae found in fungi and wood, and even under carpets. Carnivorous, long and slender, like the Therevidae. (Theobald.)

Fig. 52. *Acrocera globulus* Pz. ♀. Length 3·5 mm., wings 6 mm. (Rushall farm, Salisbury, 3 vi. 1909.) Thorax dark brown, abdomen pale yellow. Very sluggish flies, often found settled on old tree trunks and branches of trees around which they fly.

Fig. 53. *Empis tessellata* F. At rest, 12 mm. to extremity of wing. Common on hawthorn blossom. Predatory insects, the imagines seizing other insects, from which they suck the juices. They are decidedly beneficial: for examples see Prof. Poulton's "Predacious Insects and their Prey" on Empidae and their Prey, *Trans. Entomological Society of London*, 1907.

Fig. 54. *Hilara maura* F. ♂ 4·5 × 11 mm., ♀ 4 × 10·5 mm. In swarms on Bourn Brook, Grantchester. (N. D. F. Pearce.) Intense dark brown to black throughout. ♂ has forelegs dilated. The Hilarae feed on small insects, especially flies, but also Aphides. They assemble in swarms, and dance about in the air, especially over streams and pools. (Theobald.)

Fig. 55. *Chrysotus neglectus* W. ♂ 3 mm. 17 vi. 1907, Studland. An iridescent green fly with pale buff-coloured legs. N. Forest. (Adams.)

Fig. 56. *Lonchoptera lutea* Pz. ♀ 3 × 8 mm. 24 vii. 1890, Harlesden. The ♂ has different venation. A brown fly, with legs of lighter hue.

Fig. 57. *Pipunculus furcatus*. 3·5 × 10 mm. Inhabits woods and fields, and often hovers in the air. Grantchester.

Fig. 58. *Liogaster metallina* F. ♂ 6 × 11 mm. Distinguished from Chrysogaster by the entirely metallic abdomen. In Chrysogaster the sides of the abdomen are shiny and the central area dull. Found on flowers of buttercup (*Ranunculus bulbosus*).

Fig. 59. *Melangyna quadrimaculata* Verr. ♂ 9 × 18 mm., ♀ 8 × 18 mm. The ♀ has no yellow markings. Always rather scarce. Painswick.

Fig. 60. *Volucella pellucens* (Volucellinae) L. ♀. At rest, 22 mm. from frons to extremity of abdomen. Said to act as scavenger in the nests of the larger Hymenoptera, or to be parasitic in their larvae, especially wasps.

Fig. 61. *Mallota cimbiciformis* (Eristalinae) Fln. ♀ 14·5 × 25 mm. On Portugal laurel or Dog Rose. New Forest (Adams), vi. 1894 and 1907. Thorax yellow pubescence. Body dark brown; legs brown, shading to golden. Rare. Many in 1897 and 1900. (Adams.) N. Forest.

Fig. 62. Pupa of *Merodon equestris* (Eristalinae). 12·5 × 6 mm. Narcissus bulb fly. Very harmful to Daffodil, Lily and Tulip bulbs.

Fig. 63. *Criorrhina floccosa* Mg. ♂ 13 × 25 mm. Bred by W. Harwood from cocoon, May 1914.
Fig. 64. Cocoon, 7 × 13 mm., from whence emerged the specimen seen. Found at root of Poplar.

Fig. 65. *Syritta pipiens* (Milesinae) L. ♀ 9 × 14 mm., ♂ 8 × 14 mm. Abundant on flowers.

Fig. 66. *Callicera aenea* (Chrysotoxinae) F. ♀ 13 × 26 mm. New Forest. A gorgeously golden-coloured fly found on leaves of briar rose. Specimen found by Miss Chawner, vii. 1901–2. Scarce. The genera, of which there are only two British species, is distinguished from Chrysotoxum by its terminal style. "Rare, but now commoner. Six found on Rhododendron blossom vii. 1898, at Rhinefields, New Forest; also on Bramble and Wild Rose: July best month." (Adams.)

Fig. 67. Pupae of *Gastrophilus equi* F. 15 × 7·5 mm. Brown to black in colour, found in meadows on and near horse droppings under the surface of grass. The horse bot larvae live in the horse's stomach. See *Typical Flies*, p. 37.

Fig. 68. *Blepharidea vulgaris* Fln. 8 × 14 mm. Destroys larvae of *Pieris rapae* (white butterfly) and many Diurnia. The commonest Tachinid parasite on Lepidoptera, attacks many species, such as *Vanessa urticae* in great abundance, *Hesperia lineola*, etc.; destroys 50 to 80 per cent. of summer broods perhaps. (Harwood.)

Fig. 69. *Tachina* (*Echinomyia*) *grossa* L. ♀ 19 × 37 mm. Parasite on larvae of Bombycid Moths. Wool, Dorset, vii. 1918.

Fig. 70. *Fabricia ferox* L. ♀ 13×25 mm. Hovering over briar at Arne Common Road, Dorset. Also found about rabbit burrows near Newbury, Berks, and sitting on sandy banks, Millbrook, Cornwall. Near Sallows.

Fig. 71. *Stomoxys calcitrans* L. ♂ 6 mm. frons to tip of abdomen. (Showing mouth parts.) Hurtful to horses, and biting people from its resting-place on windows in autumn. This species, which is grey in colour with black spottings, is the commonest biting fly among the Muscidae. It has often made horses uncontrollable, and cattle are driven wild by it. "It can be distinguished by its habit of sitting sideways." (Harwood.)

Fig. 72. (*Mydaeinae*) *Spilogaster Zoë*. ♂ 4×10 mm. Thorax and head paler brown than the abdomen, which is dark. Larvae found in decaying animal and vegetable matter. Possibly like *M. uliginosus* in rotten wood. Colchester.

Fig. 73. (*Anthomyina*) *Phorbia cepetorum* Meade. ♂ 8 mm., ♀ 9 mm. frons to tip of wing. The onion fly. Onions should be lifted and the larvae destroyed. If pulled, the grubs remain in the soil and spread to sound bulbs; a dressing of soot is recommended as preventative to attack.

Fig. 74. (*Caenosinae*) *Fucellia fucorum* Fln. 5×11 mm. 18 viii. 1900 on coast sands above high water. Found along the sea shore generally, here and in America. A pale brown fly of uniform colouring, with bristles on thorax and legs and extremity of abdomen. "Christchurch Bay." (Adams.)

Fig. 75. *Cordylura ciliata* Mg. ♂ 10·5×16 mm. Near rivers and amongst grass. Summer and autumn common. Colchester.

Fig. 76. *Neuroctena anilis* Fln. ♀ 9 × 19 mm. New Forest. (Adams.) Near damp places in summer.

Fig. 77. *Neottiophilum praeustum* Mg. ♀ 10 × 17 mm. From larvae found in finches' nests, from May 20 to end of June. New Forest. (Adams.) Golden brown abdomen, banded darker shade. Spots on wings still darker brown. Rare.

Fig. 78. *Limnia marginata* F. ♂ 7 × 13 mm., ♀ 6 × 14 mm. Found by sweeping grass near the East Coast, St Osyth. Also from inland on the Roman Road, near Cambridge. viii. 1918. (Harwood.)

Fig. 79. *Elgiva albiseta* Scop. ♂ 7 × 14 mm. Sometimes abundant amongst rush and coarse grass.

Fig. 80. *Psila fimetaria* L. ♂ 8 × 17 mm. Along hedgerows. Compare with the carrot fly, *Psila nigricornis*. Colchester.

Fig. 81. *Loxocera aristata* Pz. ♀ 10 × 14 mm. Common on beating whitethorn and on other trees near water. Sudbury, Suffolk. A dark brown fly; thorax and legs bright red brown. Smooth and devoid of hairs or bristles.

Fig. 82. *Lissa loxocerina* Fln. 8 × 10 mm. Taken on Rhamnus, New Forest, 1908. Perfectly smooth, dark brown body; legs brighter red brown.

Fig. 83. (*Ortalinae*) *Pteropaectria frondescentiae* L. ♀ 4 × 8 mm. Found in damp places on the marshes by sweeping. Wicken Fen. (N. D. F. P.) Body black, wings banded, intense dark brown.

Fig. 84. (*Ortalinae*) *Ceroxys pictus* Mg. ♂ 4 × 8 mm., ♀ 4 × 9 mm. Essex marshes; common in sweeping grass and sedge on sea coast marshes. (St Osyth, Essex.) Body grey brown, legs of same colour, darker wing spots.

Fig. 85. (*Ortalinae*) *Ceroxys crassipennis* F. ♀ 8× 17 mm. In numbers at Aviemore: and river mouth of Thames Estuary. (T. F. King.) A dull light brown fly. Wing spots and legs of brighter brown hue.

Fig. 86. (*Ortalinae*) *Anacampta urticae* L. ♀ 6× 13 mm. On Erith Marshes, 1906, and in similar localities, but generally scarce. (Andrews.) Brown stripes on wings, exceedingly dark brown body.

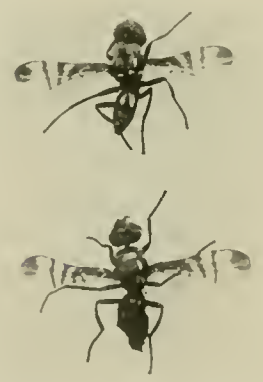


Fig. 87. (*Platystominae*) *Rivellia syngenesiae* F. ♀ 2 × 6 mm., ♂ 2 × 5 mm. Found by sweeping in meadows. 22 vi. 1896. (Adams.) A blue-black fly, brown mottled wings.

Fig. 88. (*Ulidinae*) *Seoptera vibrans* L. ♀ 6 × 12 mm. Common in gardens; runs down leaves rapidly vibrating its wings, hence the name. A black fly, with black spots on wings.

Fig. 89. *Aciura rotundiventris* Fln. 4 × 10 mm. Bred from Burdock by Mr King and by Mr Adams. New Forest. A very handsome dark brown fly, mottled dark brown wings and buff legs. Found also, Matley Bog, New Forest, on *Angelica sylvatica*.

Fig. 90. *Acidia cognata* W. ♀ 6 × 14 mm. A golden brown fly throughout, with exceptions of dark brown wing markings. "Sway, New Forest." (Adams.)

Fig. 91. *Spilographa Zoë* Mg. ♂ 4 × 10 mm. A pale brown fly with pale legs and darker wing spots. New Forest. (Adams.)

Fig. 92. *Trypeta cornuta* F. ♂ 5 × 12 mm., ♀ 8 × 14 mm. Red brown throughout, wings with paler bands. W. Suffolk.

Fig. 93. *Urophora solstitialis* L. ♀ 4 mm. to end of ovipositor, 10 mm. across wings. A fly with dark brown abdomen, but wing bands, legs and thorax brighter red brown.

Fig. 94. *Urophora stylata* F. ♀ 7 × 11 mm. Among Scotch thistles (*Onopordum acanthium*). A dark brown fly, wing bands and legs bright red brown. Galls the floral receptacle of *Cirsium lanceolatum* forming a hard, many-chambered gall. (Theobald.)

Fig. 95. *Sphenella marginata* Fln. 9 mm. across wings. A pale brown fly, wing markings pale to dark shade of brown.

Fig. 96. *Carphotricha guttularis* Mg. ♂ 4 × 8 mm., ♀ 4·5 × 9 mm. Found by sweeping among *Galium verum* at Copford, Essex. "New Forest, but not common." (Adams.) A dark brown fly, legs and wing markings bright red brown.

Fig. 97. *Tephritis plantaginis* Hal. ♂ 5 × 9·5 mm. Taken by sweeping amongst *Aster Tripolium*. Clacton-on-Sea, viii. 1911. (Harwood.) Galls the inflorescence of *Aster Tripolium*. (Theobald.) A dull brown fly, legs and wing markings slightly brighter in tint.

Fig. 98. *Tephritis hyoscyami* L. ♂ 4 × 10 mm., ♀ 6 × 11·5 mm. Taken in a patch of thistles by P. Harwood, Bishop's Stortford. A dull brown fly, legs and wing markings of lighter hue.

Fig. 99. *Tephritis vespertina* Lw. ♂ 4 × 8 mm. New Forest. Red brown mottled wings, with body of lighter grey brown shade. Larvae feed in heads of Compositae. "New Forest." (Adams.)

Fig. 100. *Tephritis bardanae* Schrk. ♂ 4·5 × 11 mm., ♀ 5 × 12·5 mm. From heads of Burdock (*Arctium Lappa*). A dull brown fly, with dark wing markings, but legs and extremity of abdomen of bright red brown. "New Forest." (Adams.) Stanway, Essex.

Fig. 101. *Palloptera umbellatarum* F. 4 × 10·5 mm. A small brown fly, with slightly infumated wings and brown spots. Abdomen yellow brown.

Fig. 102. *Palloptera decempunctata*. ♂ 4 × 10 mm. Figs. 101 and 102 are uncommon forms, found by Mr Adams beating in the New Forest occasionally, 28 vii. 1908. A light brown fly, wing spots and legs of same tint.

Fig. 103. *Toxoneura muliebris* Harr. ♂ 3·5 × 7 mm., ♀ 3·5 × 10 mm. On windows at Kempston, Bournemouth West, viii. 1917. Bright red brown fly, with white spaces on wings. Probably flew in from Ceanothus outside.

Fig. 104. *Balioptera tripunctata* Fln. ♂ 3×7 mm. New Forest, 26 viii. 1906. A dark brown fly, legs and wing spots of darker red brown.

Fig. 105. *Opomyza florum* F. ♀ 3·5×8 mm., ♂ 3×7 mm. Found by sweeping grasses, Bishop's Stortford. Pale golden brown throughout, darker shade of wing spot.

Fig. 106. *Piophila casei* L. 6×19 mm. Found at a London Club. (Adams.) 25 vii. 1898. Larvae in cheese; cheese maggot. Kept off fresh cheese by means of muslin shields. A dark brown smooth fly, with a partiality for cheese.

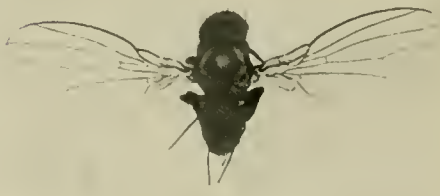


Fig. 107. *Drosophila fenestrarum* Fln. 3×9 mm. On windows, February and March, Grantchester. (N. D. F. P.) The larvae of the Drosophilidae feed on plants, oak apples, fungi, cheese. Some mine the leaves of plants. *Drosophila funebris* is often called the soft cheese fly. *D. cellaris* feeds on the matter adhering to beer and wine corks. *D. melanogaster* attacks grapes. (Theobald.)

Fig. 108. Pupa of *Drosophila funebris*. (British Museum specimen.)

Fig. 109. *Chromatomyia ilicis* Curt. ♂ 2×6 mm., ♀ 2·5×7 mm. Emerges from Holly Leaves. The pupae are concealed in varicoloured blotches. Young leaves attacked by the fly are very disfiguring to ornamental hollies. Kempston, Bournemouth West, vi. 1916.

Fig. 110. *Borborus equinus* Fln. ♀ 4·5×10 mm. New Forest. (Adams.) A dark brown fly, portions of legs of brighter brown hue. The larvae feed in decaying substances. (Theobald.)

Fig. 111. *Limosina pumilio* Mg. 3×7 mm. Feb. and March. Fountain, Grantchester. (N. D. F. P.) A dark brown fly throughout. Injurious to Rhubarb roots. (Theobald.)

Fig. 112. *Phora opaca* Mg. 2×6 mm. March and April, near fountain and windows at Grantchester, 1910. Larvae of the Phoridae are cylindrical, thinner in front than behind, and live in dead insects and snails and decaying vegetable matter. (Theobald.)

In the Eproboscidea the ovum hatches within the body of the parent, and is deposited as a larva and pupates rapidly. (See *Cambridge Nat. Hist.* vol. VI. p. 517, and *British Bloodsucking Flies*, E. E. Austen, p. 62, family Hippoboscidae.)

Figs. 113, 114. *Hippobosca equina* L. 7 × 18 mm. New Forest, 19 ix. 1915. (Adams.) These flies are found on the Forest ponies. Horses not used to them, when attacked, become unmanageable.

♂.

Figs. 115, 116. *Stenopteryx hirundinis* L. ♂ 3 mm., 5 mm. Found as spherical dark brown puparia in the nests of Martins and Swallows, Hauxton Mill. (N. D. F. Pearce.) Bred out Sept.-Oct. 1917. A pale brown fly throughout.

Fig. 117. *Lipoptena cervi* L. ♀ 6 mm. Parasite of *Capreolus caprea*. Micro-slide of Rothschild collection, Tring. (By permission.)

Fig. 118. *Braula caeca* Nitz. Found on bees at Grantchester by N. D. F. Pearce. Off a worker of *Apis mellifica*. vii. 1915. This is one of the well-known Hive Bee Parasites.

Fig. 119. *Nycteribia* (*Listropodia*) *pedicularia* Latreille. ♀ ventral view. From *Vespertilio daubentoni*. Wells Cathedral, Somerset. vi. 1906. 2·5 mm. From micro-slide, Rothschild collection, Tring. (By permission.)

Fig. 120. Legs of *Nycteribia pedicularia* enlarged.

Fig. 121. *Nycteribia* (*Listropodia*) *pedicularia* Latr. var. *blasii* (Kolenati) Scott. ♀ 2·2 mm. ventral view. From *Vespertilio daubentoni*, Henley-on-Thames. 14 ii. 1906. From micro-slide, Rothschild collection, Tring. (By permission.)

Fig. 122. *Nycteribia* (*Stylidia*) *biarticulata* Hermann. ♀ 3 mm. dorsal view. From *Rhinolophus ferrum equinum*. 12 v. 1912. From micro-slide, Rothschild collection, Tring. (By permission.)

In *Parasitology* (University Press, Cambridge), vol. IX. no. 4, July 27, 1917, will be found an interesting general account of the *Nycteribiidae*, with description of two new genera by Dr Hugh Scott. And in *The National Review* of Aug. 1919, another account by Mr H. Russell in a paper entitled "Wingless Flies" is of interest to students.

I am indebted to Dr Scott for the names of the three British *Nycteribiidae* illustrated in these pages; and to Mr Harold Russell for his trouble to secure the loan of *Nycteribiidae* for my illustrations. It should be here stated that *blasii* and *pedicularia* are "not absolutely identical," but Dr Scott considers the difference insufficient to entitle the former to specific rank, but rather that they should be looked upon as two forms of the same species.

Nycteribiidae of different genera and species have been found not only on the same bat species, but upon the same bat individual (Scott).

APPENDIX TO VOL. II

Fig. 123. ♂.

Fig. 124. ♀.

Figs. 123, 124. *Microdon mutabilis* L. ♂ 11 × 20 mm. Pale silver pubescence across abdomen and on frons. ♀ 11 × 21 mm. Golden tawny pubescence across abdomen and on frons. (Bred by Rosse, Butterfield, Yorkshire.) "The larvae found in ants nests and under bark on stumps of trees long cut down, the nest being generally of *Formica fusca*. Fly emerges middle of May, near Lymington. The wings of bred specimens are often wet and dirty from material of nest, generally Ash and Aldridge Hill Pine. Wild specimens often have frayed wings." (Jones.)

Fig. 125. *Pamponerus germanicus* L. ♀ 19×36 mm. (P. Harwood, Glamorgan, vi. 1920.) Wings brownish, face bearded: said by Verrall to be dying out in England. Rare.

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